To: Ingersoll, Christopher[cingersoll@usgs.gov]; Hammer, Edward[hammer.edward@epa.gov]
Cc: Bauer, Candice[bauer.candice@epa.gov]; Ning Wang[nwang@usgs.gov]; Riecks-Soucek, David John[soucek@illinois.edu]; Thomas Scott[tscott@usgs.gov]
From: Mount, Dave
Sent: Tue 11/18/2014 2:46:56 PM
Subject: RE: Sulfate Toxicity to Wild Rice - Poster Attached

As background for those not following the wild rice issue. . .

The study described on the poster was a (IMHO) thinly veiled attempt by certain interests to discredit the MN sulfate standard for wild rice waters. The issue for wild rice is not that sulfate is directly toxic; the presumed (and well supported though not necessarily "proven") mechanism involved is sulfate in surface water providing substrate to sulfate reducing bacteria in sediment, increasing sediment sulfide to which wild rice (and domestic rice) is sensitive. That aspect of environmental exposure to sulfate is not addressed by this experimental approach. A cynic could easily assert that this study is willfully maintains ignorance of the larger issues in an attempt to make the MN standard appear foolish. The sensitivity of wild rice to sulfide, as well as its insensitivity to sulfate (only), is clearly shown in hydroponic studies conducted by UM-Duluth.

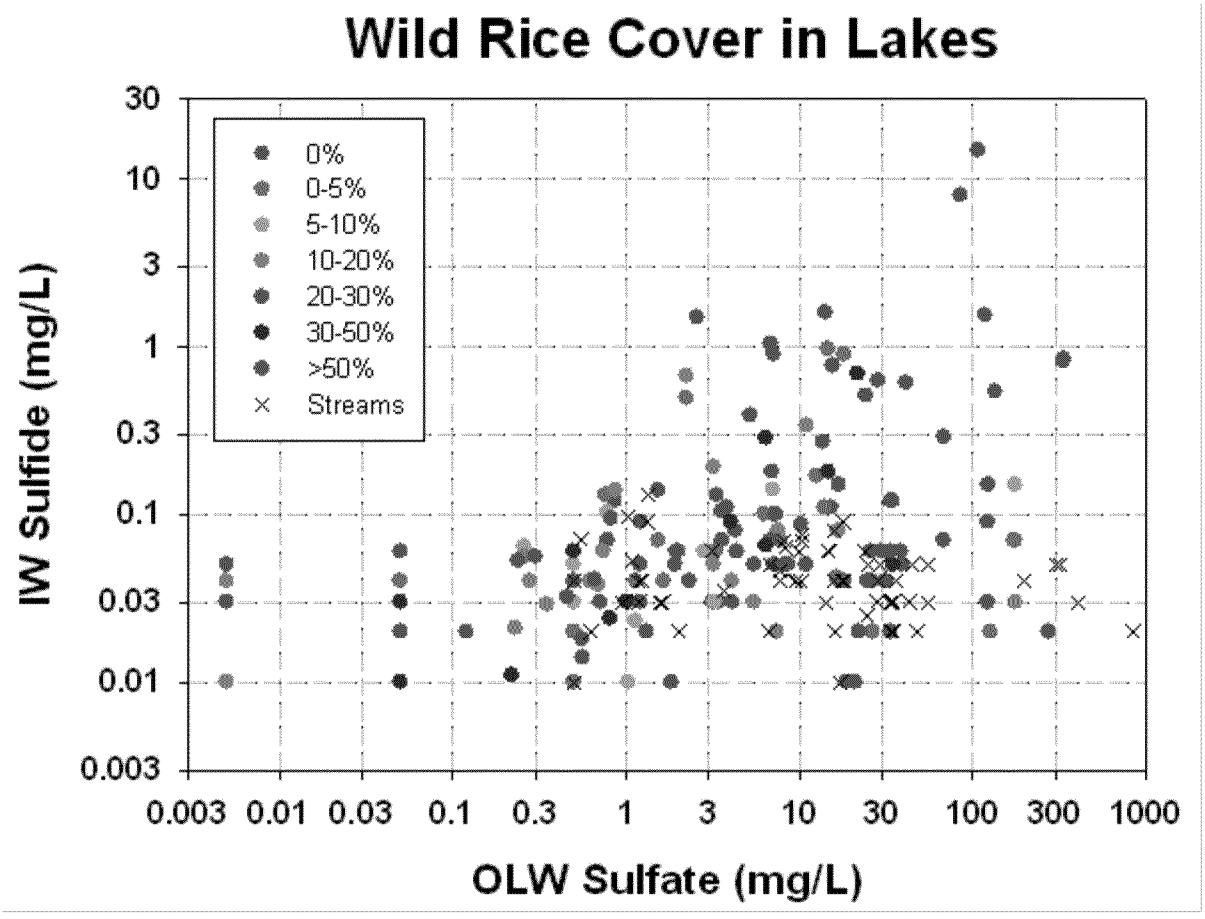
It is a complicated problem because susceptibility to increased sulfate is also influenced by iron availability. If there is excess iron around in the sediment, then the increased sulfide production is bound and does not rise as much. The consequences also seem to differ between lakes and flowing waters. Many commercial growers operate successfully using high sulfate waters, but they manage the water levels to bring oxygen into the substrate and oxidize sulfide.

Below is a plot I made from lake survey data the MPCA sponsored (by way of disclosure, Russ Erickson and I have met with MPCA staff a few times to discuss their studies and data analysis, but we don't hold a formal position in all this; I made the plots below out of scientific curiosity, though MPCA subsequently adopted some of the approaches for their report). Surface water sulfate is shown on the X and interstitial water sulfide on the Y. Data from lakes are shown as dots, color coded relative to the % wild rice cover (warmer colors mean less rice). Stream data are shown as X's, regardless of wild rice cover. Bear in mind these are generally one-time samples from one location (i.e., the degree to which this sample adequately represents the entire lake/stream is uncertain and could be a source of additional scatter). While there is clearly scatter, several conclusions seem reasonable:

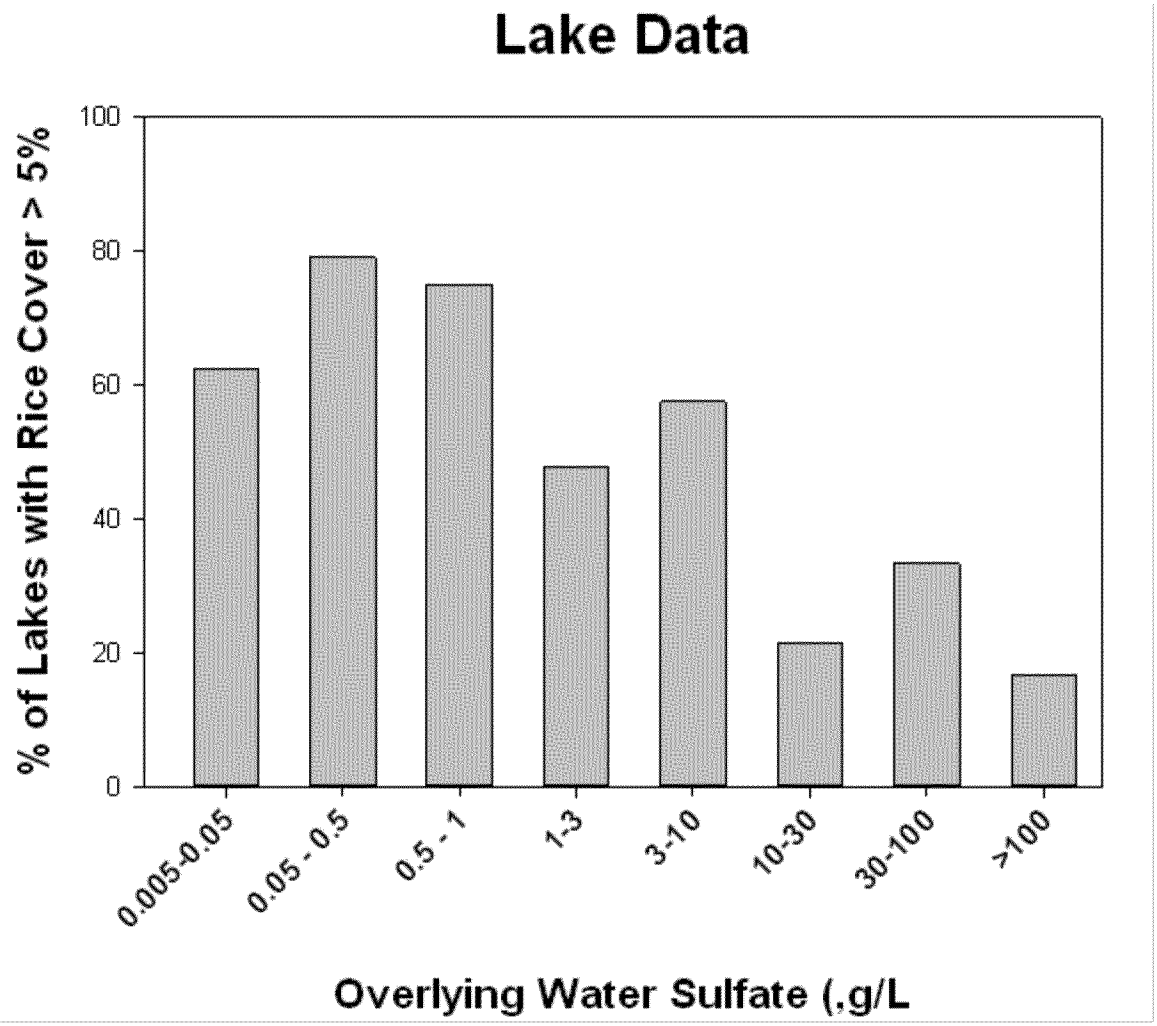
1) You don't get higher IW sulfide without having elevated sulfate, though high OLW sulfate does not always cause high IW sulfide (thought to be iron effects).

2) As you move from low to high on either axis the robustness of the wild rice stand decreases.

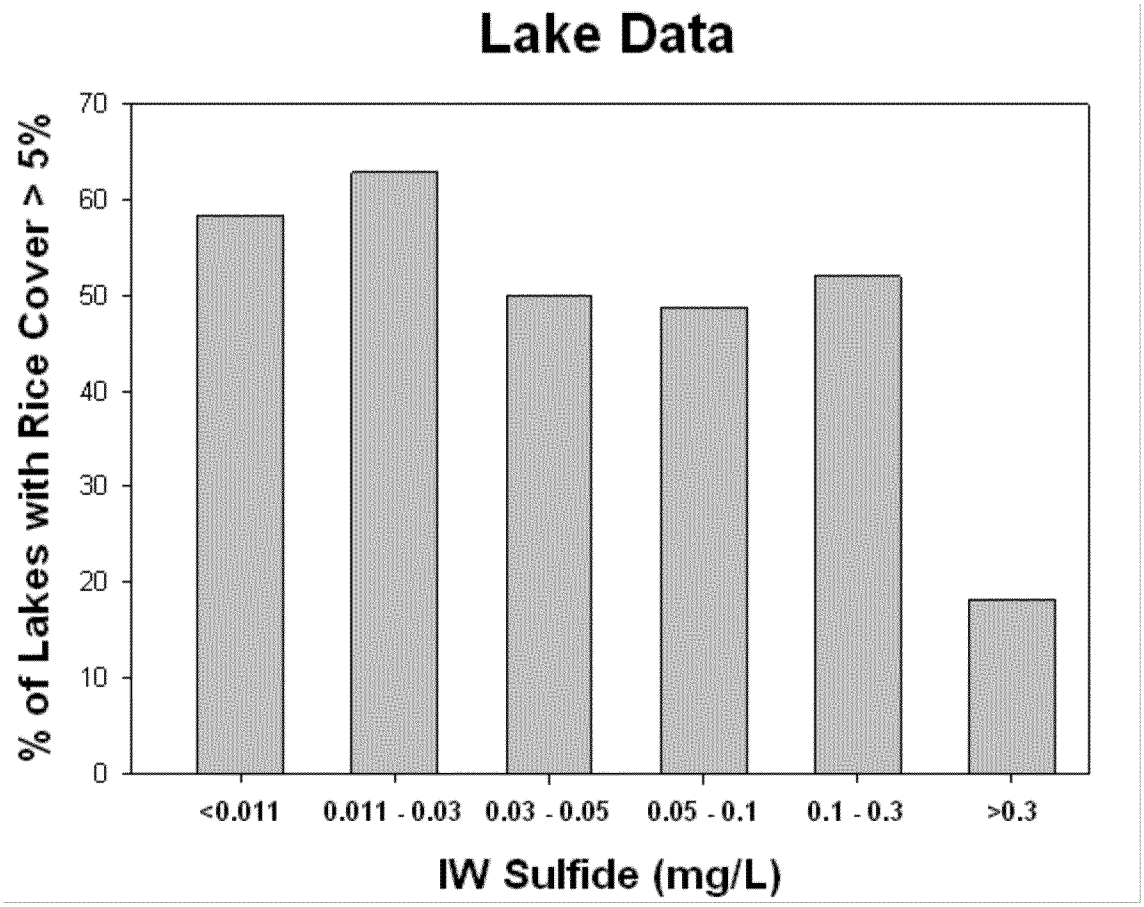
3) Something very different is happening in streams, where IW sulfide was never as high as in some lakes.



Here are frequency histograms for both OLW sulfate and IW sulfide:



Note that 10 mg/L does seem to separate lakes into higher and lower frequency groups.



From: Ingersoll, Christopher [mailto:cingersoll@usgs.gov]
Sent: Tuesday, November 18, 2014 8:09 AM
To: Hammer, Edward
Cc: Bauer, Candice; Ning Wang; Mount, Dave; Riecks-Soucek, David John; Thomas Scott
Subject: Fwd: Sulfate Toxicity to Wild Rice - Poster Attached

Ed et al.:

A the attached poster presented at the SETAC meeting in Vancouver, indicating that wild rice was not very sensitive to sulfate.

Chris Ingersoll

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cingersoll@usgs.gov, http://igskrgcbwb01050/StaffMembers.aspx?StaffMemberId=192

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_.>/ _ "Almost never a bad time to ride a bike"

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---------- Forwarded message ----------
From: **Scott Hall** <shall@environcorp.com>
Date: Tue, Nov 18, 2014 at 7:49 AM
Subject: Sulfate Toxicity to Wild Rice - Poster Attached
To: "cingersoll@usgs.gov" <cingersoll@usgs.gov>, "nlove@geiconsultants.com" <nlove@geiconsultants.com>, "matt.moore@ars.usda.gov" <matt.moore@ars.usda.gov>, "ciel0001@hotmail.com" <ciel0001@hotmail.com>, Rob Reash <rjreash@aep.com>, "dhattermann@landisintl.com" <dhattermann@landisintl.com>, "brian_yates@baylor.edu" <brian_yates@baylor.edu>, "ceepina@nus.edu.sg" <ceepina@nus.edu.sg>

Thank you for your interest in my poster related to sulfate toxicity to wild rice, a copy is attached.

Scott

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